



# AEC-NASA TECH BRIEF



AEC-NASA Tech Briefs describe innovations resulting from the research and development program of the U.S. AEC or from AEC-NASA interagency efforts. They are issued to encourage commercial application. Tech Briefs are published by NASA and may be purchased, at 15 cents each, from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

## Dispersion of Borax in Plastic Is Excellent Fire-Retardant Heat Insulator

### The problem:

To develop a plastic composition that is fire-retardant, yields a minimum of toxic gases when heated, and exhibits high thermal insulating properties. Fire-retardant resin compositions presently available burn through too quickly when exposed to a high temperature flame such as an oxyacetylene torch and release a large amount of black sooty aromatic smoke which clogs AEC filters.

### The solution:

A mix of borax powder and a chlorinated anhydrous polyester resin. The resultant composition resists decomposition, exhibits high thermal insulation properties, releases few toxic gases, releases only a white smoke which passes through the AEC filters, and is self-extinguishing when exposed to an oxyacetylene flame.

### How it's done:

Crystallized or powdered borax ( $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ ) is added to an anhydrous chlorinated polyester resin. Sodium bicarbonate is added, and the entire mixture is cured according to the temperature and procedures applicable to the particular resin used. Chlorine-containing resins, such as polyvinyl chloride, vinyl chloride copolymers, chlorinated polyolefins, chlorinated epoxies, chlorinated rubbers, chlorosulfonated polyethylenes, and chlorinated polyesters are also suitable for this process.

The borax is used in a quantity of between 30 and 70 parts by weight for 100 parts of resin, with 60 parts of borax being the optimal quantity. Crystals of the borax are satisfactory, but the powdered compound yields superior results. Sodium bicarbonate is added in an amount of from 10 to 30 parts

by weight per 100 parts of resin, with 20 parts of bicarbonate the optimal quantity.

Areas of the composition exposed to high heat form a hard, crusty, nonspalling, carbonaceous layer containing fireproof  $\text{Na}_2\text{B}_4\text{O}_7$  and fused  $\text{NaCl}$ . The fused  $\text{NaCl}$  results from further decomposition of the  $\text{Na}_2\text{B}_4\text{O}_7$  in the presence of released chlorine. Very little corrosive hydrogen chloride or chlorine gas evolves since the chlorine is largely used up in the formation of the sodium chloride.

### Notes:

1. This composition can be used as a coating or can be converted into laminated or cast shapes.
2. Nonchlorinated resins may also be used, but they do not produce results that are as satisfactory as the chlorinated resins.
3. Most experiments leading to the development of this process involved a chlorinated resin obtained from hexachloroendomethylene tetrahydrophthalic acid prepared by the process of U.S. patent No. 2,606,910, and glycol, which were crosslinked by styrene. A series of tests using this resin were conducted in which samples of (1) the pure resin, (2) the resin mixed with borax, and (3) the resin mixed with borax and sodium bicarbonate were evaluated. The samples were exposed to the flame of a meker burner, a hydrogen-oxygen torch, an oxyacetylene torch, a plasma gun, and to a constant temperature in a furnace at  $785^\circ\text{C}$ . In all tests, samples (2) and (3) were found to be self-extinguishing, to decompose only locally near the flame, to exhibit considerable thermal insulating properties, and to emit little smoke. The pure resin sample (1) was markedly inferior to samples (2) and (3) in all the above properties.

(continued overleaf)

4. Inquiries concerning this innovation may be directed to:

Office of Industrial Cooperation  
Argonne National Laboratory  
9700 S. Cass Avenue  
Argonne, Illinois 60439  
Reference: B67-10016

**Patent status:**

Inquiries about obtaining rights for commercial use of this innovation may be made to:

Mr. George H. Lee, Chief  
Chicago Patent Group  
U.S. Atomic Energy Commission  
Chicago Operations Office  
9800 S. Cass Avenue  
Argonne, Illinois 60439

Source: John Hughes, Fred Schmitz  
and Harold Evans  
Chemistry Division  
(ARG-5)